Computer-Based Instruments

NI 2565 User Manual

16-Channel Mechanical Relay Switch

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Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Notices to User: ***Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.***

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This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Conventions

The following conventions are used in this manual.

< >	Angle brackets containing numbers separated by an ellipsis represent a range of values associated with a port, bit, or signal name (for example, CH<0..15> stands for the signals CH0 through CH15).
	This icon to the left of bold italicized text denotes a note, which alerts you to important information.
	This icon to the left of bold italicized text denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
	This icon to the left of bold italicized text denotes a warning, which advises you of precautions to take to avoid being electrically shocked.
bold italic	Bold italic text denotes a note, caution, or warning.
italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text from which you supply the appropriate word or value, as in CH*x*.

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1

Routing Signals with Your NI 2565

This manual describes the electrical and mechanical aspects of the NI 2565 general-purpose 16-channel 1form A mechanical relay switch card and contains information concerning its installation and operation.

About the NI 2565

This section summarizes the features and operation of the NI 2565 switch card. Refer to Chapter 2, *NI 2565 Operation*, for more complete details. In addition, refer to Appendix A, *Specifications*, for detailed specifications of the switch card.

The NI 2565 is a 16-channel general purpose relay switch card. The NI 2565 uses single-pole single-throw (also known as 1form A) relays. The board can switch voltages up to 250 VAC and 125 VDC, and currents up to 7 A AC and 5 A DC. You can use the National Instruments NI-SWITCH software included with your kit to configure and operate the NI 2565 switch card.

Triggers

Two triggers are used to handshake the NI 2565 switch with other PXI instruments. The *Scanner Advanced* trigger indicates when the card has closed all the necessary switches for the next scan and the switches have settled, or *debounced*.

The *External Trigger Input* trigger is sourced by another instrument or by software, and causes the NI 2565 to advance to the next entry in the scan list. The triggers can be routed to any of the PXI TTL triggers or to the PXI star trigger. If no external trigger input is available, you can have the software trigger the NI 2565 to advance to the next entry in the scan list.

Refer to Chapter 2, *NI 2565 Operation*, for more information on triggers.

High Voltage

The NI 2565 general purpose switch card is rated for reinforced insulation, 250 V, Cat. II. This classification provides safety insulation from any terminal to any other accessible part on the card. The switch card is rated for basic insulation, 250 V Cat. II, from any screw terminal connection to any other screw terminal connection.

Insulation coordination can be achieved only if transient overvoltages are controlled to specified levels. Refer to the *Glossary* for more information about Categories I and II overvoltage specifications.

Caution ***For additional safety, if you will be switching power lines or high voltage, place an F7A 250 V in-line fuse before the switch card.***

Always disconnect the screw terminal plug from the front connector before removing the module from the PXI chassis.

Before applying high voltage to the module, always tighten the four captive screws to provide a ground connection from the module to the chassis.

Warning ***Do not exceed 250 V channel-to-channel or channel-to-ground. Any connections that exceed the maximum settings for the NI 2565 can result in an electrical shock hazard and damage to the switch card and any or all of the boards connected to the PXI backplane. National Instruments is NOT liable for any damages or injuries resulting from exceeding maximum voltage ratings. Refer to Appendix A, Specifications, for information.***

Contact Protection

Caution ***When inductive loads are connected to the relays, a large counter electromotive force may occur at relay switching time due to the energy stored in the inductive load. These flyback voltages can severely damage the relay contacts and greatly shorten the life of the relay.***

It is best to limit flyback voltages at your inductive load by installing a flyback diode for DC loads or a varistor for AC loads. Refer to Appendix B, Customizing Your Card, for more information on flyback voltage protection.

Connecting Signals

This section describes the signal connections to the NI 2565 module via the module front connector. This section also includes specifications and connection instructions for the signals on the NI 2565 module connectors.

Caution ***Static electricity is a major cause of component failure. To prevent damage to the electrical components in the module, observe antistatic precautions whenever removing a module from the chassis or whenever working on a module.***

Front Connector

The following diagram shows the pin assignments for the NI 2565 front connector. Table 1-1 describes the connector signals.

	A	B	
CH0	1	1	CH8
COM0	2	2	COM8
CH1	3	3	CH9
COM1	4	4	COM9
CH2	5	5	CH10
COM2	6	6	COM10
CH3	7	7	CH11
COM3	8	8	COM11
CH4	9	9	CH12
COM4	10	10	COM12
CH5	11	11	CH13
COM5	12	12	COM13
CH6	13	13	CH14
COM6	14	14	COM14
CH7	15	15	CH15
COM7	16	16	COM15

Figure 1-1. Front Connector Pinout Assignments

Table 1-1. Front Connector Signal Description

Signal Name	Type	Description
CH<0..15>	Input/Output	Channels—Where signals are connected to the switch card.
COM<0..15>	Input/Output	Common—The common for the respective channel.

Screw Terminal Accessory

Your kit includes a screw terminal mini-combicon connector with protective housing and strain relief.

Software Choices

You have several options to choose from when programming your National Instruments switch card. You can use the NI-SWITCH driver software or National Instruments application software.

NI-SWITCH Driver Software

The NI-SWITCH instrument driver is an Interchangeable Virtual Instrument (IVI compliant instrument driver that is bundled with NI-SWITCH cards at no cost).

NI-SWITCH features a set of operations and attributes that exercise all the functionality of the switching hardware, including configuration, opening/closing, and scanning. In addition, NI-SWITCH comes with an interactive soft front panel and online documentation.

NI-SWITCH eliminates the need to understand complex register programming and interrupt handling in the Microsoft operating systems, and frees you to focus on creating your test system.

National Instruments Application Software

LabVIEW and LabWindows/CVI are innovative program development software packages for data acquisition and control applications. LabVIEW uses graphical programming, whereas LabWindows/CVI enhances traditional programming languages. Both packages include extensive libraries for data acquisition, instrument control, data analysis, and graphical data presentation. Using LabVIEW or LabWindows/CVI can significantly reduce the development time for your data acquisition and control application.

LabVIEW features interactive graphics, a state-of-the-art user interface, and a powerful graphical programming language. The LabVIEW NI-SWITCH VI Library, a series of virtual instruments (VIs) for using LabVIEW with National Instruments switch hardware, is included with the NI-SWITCH driver.

LabWindows/CVI features interactive graphics, a state-of-the-art user interface, and uses the ANSI standard C programming language. The LabWindows/CVI NI-SWITCH Library, a series of functions for using LabWindows/CVI with National Instruments switch hardware, is included with the NI-SWITCH driver.

Third-Party Software

The NI-SWITCH instrument driver also includes support files for Microsoft Visual C++ and Microsoft Visual Basic. See the NI-SWITCH readme file for version support information.

2

NI 2565 Operation

This chapter contains safety instructions and a functional overview of the NI 2565 switch card, and explains the operation of each functional unit making up the switch card.

Safety Instructions

Caution ***Do not operate this instrument in an explosive atmosphere or where there may be flammable gases or fumes.***

Equipment described in this document must be used in an Installation Category II environment per IEC 664. This category requires local level supply mains-connected installation.

To prevent safety hazards, the maximum voltage between any of the channel inputs and the ground of the computer should never exceed ±250 VDC or 250 V_{rms}.

Do not operate damaged equipment. The safety protection features built into this instrument can become impaired if the instrument becomes damaged in any way. If the instrument is damaged, do not use it until service-trained personnel can check its safety. If necessary, return the instrument to National Instruments for service and repair to ensure that its safety is not compromised.

Do not operate this instrument in a manner that contradicts the information specified in this document. Misuse of this instrument could result in a shock hazard.

Do not substitute parts or modify equipment beyond what is described in Appendix B, Customizing Your Card. Because of the danger of introducing additional hazards, do not install unauthorized parts or modify the instrument. Return the instrument to National Instruments for service and repair to ensure that its safety is not compromised.

Connections that exceed any of the maximum signal ratings on the NI 2565 can create a shock or fire hazard or can damage any or all of the devices connected to

the NI 2565. National Instruments is NOT LIABLE FOR ANY DAMAGES OR INJURIES resulting from incorrect signal connections.

Clean instrument and accessories by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with a stiff nonmetallic brush. The unit must be completely dry and free from contaminants before returning to service.

Functional Overview

The following block diagram illustrates the key functional components of the NI 2565 switch card module.

The major components of the NI 2565 module are as follows:

- General purpose relays
- Relay switch control circuitry
- Random scanning
- PXIbus interface
- Triggers

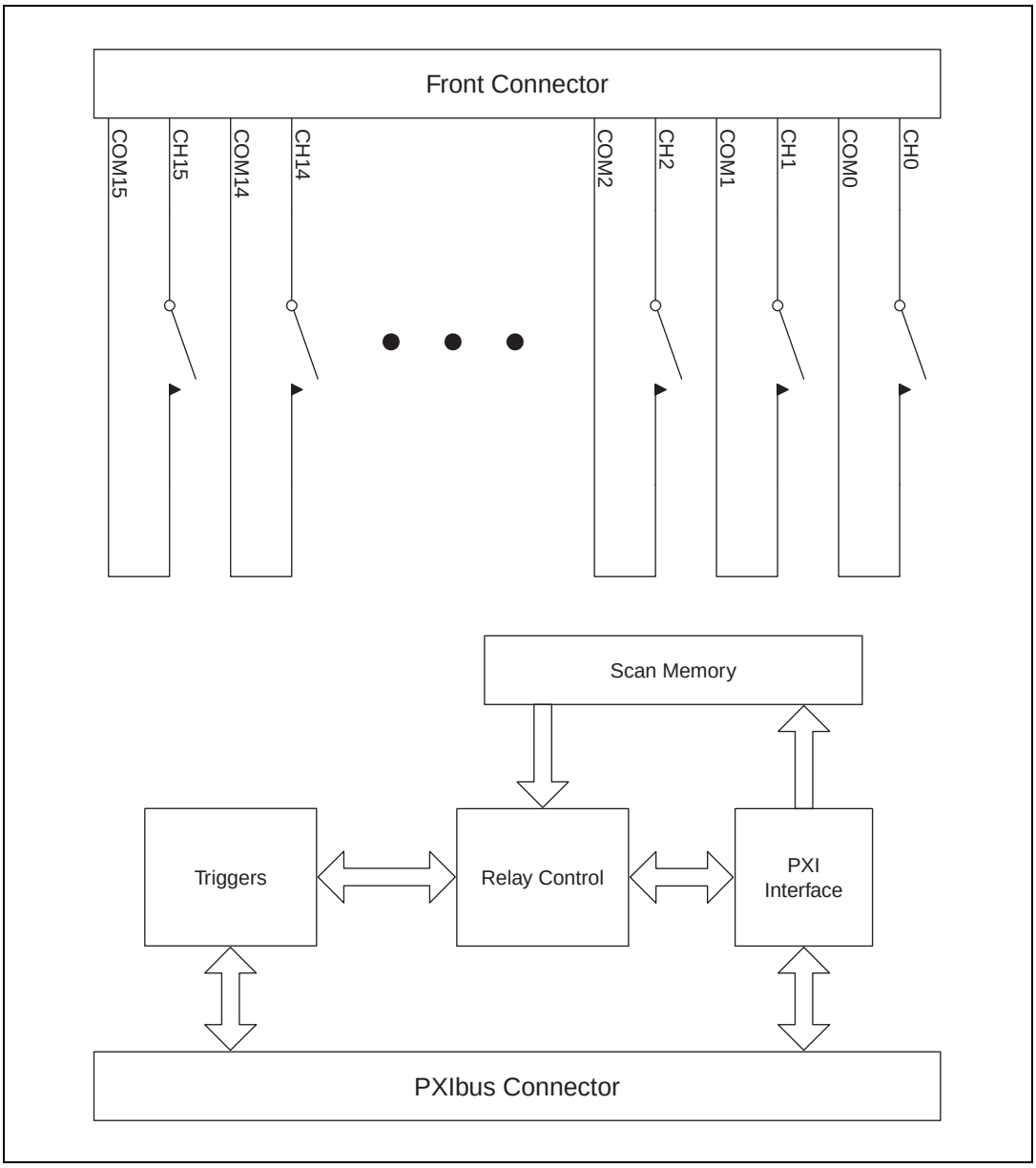


Figure 2-1. NI 2565 Module Block Diagram

General Purpose Relays

The general-purpose relay consists of 16 channels (CH0 through CH15). Each channel has a corresponding common (COM0 through COM15).

Each channel connects to the corresponding common by closing its relay. The relay name is based on the corresponding signal name. For example, the relay connecting CH9 to COM9 is CH9. You can have multiple channels connected to the corresponding commons simultaneously. See Appendix C, *Architecture Drawing*, for an illustration of the NI 2565 architecture.

The NI 2565 relays are single-side stable. When power is removed from the relay coil, the relay returns to its de-energized state. The de-energized state opens all the relays, disconnecting each channel signal from its corresponding common.

Switch Control Circuitry

The switch control circuitry (SCC) is responsible for opening and closing relays on the NI 2565. You can load commands for the SCC into memory storage using the driver software you received with your kit. Consult the online help or your software documentation for specific information on the appropriate commands. There are two reasons for storing the commands in memory before the SCC can process them:

- The operate and release times for the NI 2565 are 10 ms and 5 ms, respectively. Using memory storage, the software can send multiple commands to the SCC without having to wait for a relay action to complete.
- The memory is used to store a scan list necessary for hardware random scanning.

Random Scanning

The NI 2565 can perform random scanning. In random scanning, the switch card can open or close relays in any order.

The scan list is downloaded to onboard memory. Commands in the scan list can:

- Open or close relays
- Wait for an external trigger

- Generate a scanner advanced trigger
- Generate a breakpoint interrupt

You can use the driver software to configure the switch card for continuous or one-time scanning. In continuous scanning, the switch card cycles through the scan list until you disable scanning. For one-time scanning, the switch card runs through the scan list only once.

You can also use software commands to clear the scan list or reset it to the beginning at any time.

The onboard control logic for the NI 2565 switch card gives you direct access to open and close the relays, and also the capability to download up to 1024 random scanning instructions. The software included with the card automatically configures the NI 2565 and downloads the scan list to hardware for you. The scan list itself downloads directly into the memory of the card to deliver the fastest scan possible with no controller intervention. You can configure the switch card to process the scan list once or to continuously loop through the scan list.

PXI Interface

The NI 2565 switch card has a PXI interface through which you can use your driver software to configure and control the card. The NI 2565 takes advantage of PXI features. It uses the PXI TTL triggers to synchronize scanning with a measurement device such as a National Instruments NI 4060 PXI digital multimeter (DMM).

Triggers

External Trigger Input

The NI 2565 can use an external trigger input to advance between scan setups in a scan list. Using the driver software, you can configure the switch card to route the external trigger from any of the PXI TTL trigger lines or the PXI star trigger. Alternatively, you can use a software command to trigger the switch card.

All external trigger lines are compatible with TTL voltage levels and are edge sensitive. The minimum pulse width from the PXI TTL triggers and PXI star trigger is 70 ns.

Scanner Advanced

The NI 2565 can generate a scanner advanced trigger to indicate when the switch card is set up and ready to take measurements. Using the driver software, you can configure the switch card to route the scanner advanced (SCANADV) trigger to any PXI TTL trigger line or to the PXI star trigger. You can configure the switch card to generate the SCANADV trigger when a relay has settled (or debounced).

Because the NI 2565 has open collector drives on the PXI TTL trigger lines, you can have multiple switch cards using the same trigger line in the multicard SCANADV mode.

Modes

SCANADV has two modes of operation. In its default mode, the SCANADV trigger asserts for 1 µs after the relay has debounced. You can also configure the switch card for handshaking mode, in which the SCANADV trigger goes high after a relay settles, and the SCANADV trigger goes low after the external trigger input asserts. You can use this handshaking mode for multicard scanning.

☞ **Note** ***The NI 2565 ignores external triggers when it is not in a wait-for-trigger state while scanning.***

Initiating Scanning

When you use the NI 2565 to initiate a scan, make sure the measurement device is armed (waiting for trigger) before enabling scanning on the switch card. Enabling scanning causes the first switch(es) in the scan list to close and generates a scanner advanced trigger after the relay switches have settled or debounced.

When you use the measurement device to initiate a scan, make sure scanning is enabled on the NI 2565 before the measurement device starts to take measurements. This ensures that the switch card has the correct signal routed and that the switch card is waiting for an external trigger from the measurement device.

Always configure the triggers in a system before configuring the measurement device or the NI 2565 for scanning. When triggers are configured, a state change or pulse could occur on the trigger line. This is also possible when you reset the switch card.

Multicard Triggering

You can use multiple NI 2565 switch cards—or multiple other National Instruments switch cards such as the NI 2503—together in conjunction with an instrument such as a DMM. In multiple switch-card systems, be sure to identify one switch card as the master switch card.

All other switch cards for the system are identified as slave switch cards. The master switch card can route an external trigger from the front connector to a PXI backplane trigger. In addition, the master switch card can route the SCANADV trigger from the PXI backplane to either the front connector or another backplane trigger. This functionality makes it possible to wire external triggers from/to only one switch card in the system, which simplifies the wiring scheme.

☞ **Note** ***The NI 2565 does not support triggers on the front panel connector. If the measurement instrument is external to the chassis you must use a different National Instruments switch card, such as the NI 2503, as the master switch card.***

For more information, refer to the *NI-SWITCH Software User Manual*.

A

Specifications

This appendix lists the specifications for the NI 2565 switch card. These specifications are typical at 25° C unless otherwise noted.

Input Characteristics

Number of Relays 16

Common Mode Voltage

Channel to Channel..... 250 V_{rms}/250 VDC

Channel to Earth ..... 250 V_{rms}/250 VDC

Maximum Switching Voltage

AC..... 250 V_{rms}

DC..... 125 VDC

Maximum Switching Capacity per Channel

DC..... 5 A @ 30 VDC (resistive load)

DC..... 3 A @ 30 VDC (inductive load)

AC..... 7 A @ 250 VAC (resistive load)

AC..... 5 A @ 250 VAC (inductive load)

Maximum Switching
Power per Channel..... 1750 VA, 150 W

Contact On Resistance (Initial)..... 30 mΩ

Contact Material..... Gold-flash over silver alloy

Dynamic Characteristics

Maximum Switching Rate .....5 cycles/s at rated load

Relay Operate Time (@ 20° C)

Typical.....5 ms

Maximum .....10 ms

Relay Release Time (@ 20° C)

Typical.....4 ms

Maximum .....5 ms

Expected Life

Mechanical (@ 180 cpm) .....5×10^7 operations

Electrical at Maximum Switching Capacity.....10^5 operations

Caution ***Exceeding the maximum switching capability will decrease the expected life of the NI 2565.***

PXI Bus Interface

Slave

PXI Trigger Bus

Trigger Lines 8

Star Trigger.....1

Power Requirement

+5 VDC

Minimum (All Relays Opened).....350 mA

Maximum (All Relays Closed).....1.4 A

Generated Wattage

All Relays Opened.....1.75 W

All Relays Closed, 0.0 A per Channel....7.0 W

All Relays Closed, 5.0 A per Channel....21.5 W

All Relays Closed, 7.0 A per Channel....35.0 W

Physical

Dimensions ..... 10 by 16 by 4 cm (3.9 by 6.3 by 1.6 in)

Weight ..... 0.41 kg (0.9 lb)

I/O Connector ..... 16 x 2 mini-combicon header

I/O Mating Connector ..... Two 1 x 16 mini-combicon connectors

Environment

Operating Temperature ..... 0° to 50° C

Storage Temperature ..... –20° to 70° C

Relative Humidity ..... 5% to 85% non-condensing

Maximum Altitude ..... 2,000 m

Safety

Approved Usage ..... UL-listed PXI or Compact PCI Chassis

Installation Category ..... Category II, Pollution Degree II

Reinforced Insulation Rating, Channel to Earth ..... 250 V

Basic Insulation Rating, Channel to Channel ..... 250 V

Certifications and Compliances

CE Mark Compliance CE

This product meets applicable EU directives as follows:

Safety Isolation ..... low-voltage safety, EN 61010-1:1993

EMC Directive

- Immunity ..... EN 50082-1:1992
- Emissions ..... EN 55011:1991, Group 1 Class A at 10 m

B

Customizing Your Card

This appendix describes options for customizing your NI 2565 card.

Flyback Voltage Protection

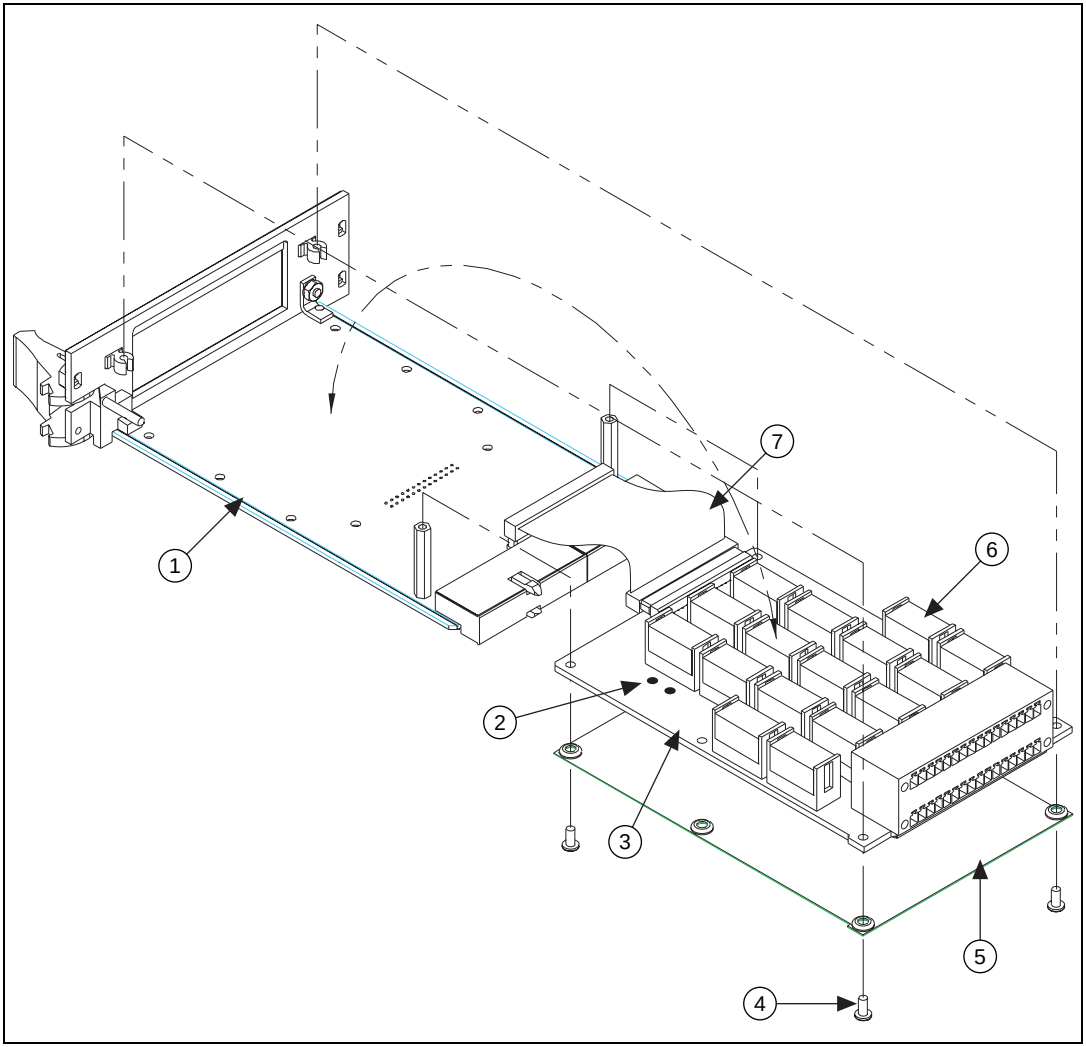
When inductive loads are connected to the relays, a large counter electromotive force may occur at relay switching time due to the energy stored in the inductive load. These flyback voltages can severely damage the relay contacts and greatly shorten the life of the relay.

You can limit flyback voltages at your inductive load by installing a flyback diode for DC loads or a varistor for AC loads. The NI 2565 module has solder connections for a diode or varistor. With this diode/varistor installed, you can limit flyback voltages when switching inductive loads.

Caution ***Before installing the diode or varistor in your module, ensure that no signals are connected to your module front connector.***

Before installing your module in the PXI chassis, install the diode/varistor by performing the following steps. Refer to Figure B-1.

1. Ground yourself via a grounding strap or a ground connected to your PXI chassis. Properly grounding yourself prevents damage to your PXI module from electrostatic discharge.
2. Loosen the four screws that fasten the NI 2565 relay module board to the switch carrier module and front panel.



1	Carrier module	3	Relay module	5	Insulator	7	Ribbon cable
2	Solder location for flyback voltage protection device	4	Screws	6	Relay and socket		

Figure B-1. NI 2565 Parts Locator Diagram

3. Remove the plastic insulator cover.
4. Lift up the card and disconnect the ribbon cable from the relay module.
5. Insert the diode/varistor into the appropriate location, labeled RV*x*, where *x* corresponds to the channel number.
6. Solder and trim the leads.
7. Reassemble the module.

Replacing Relays

The NI 2565 uses socketed relays, which are easy to replace when they fail. The electrical life of the relay is approximately 10^5 operations when switching at the rated load.

You can order a relay replacement kit from National Instruments. The replacement kit includes 16 new relays. Follow these instructions to replace the failed relay. Refer to Figure B-1.

1. Ground yourself via a grounding strap or a ground connected to your PXI chassis. Properly grounding yourself prevents damage to your PXI module from electrostatic discharge.
2. Remove the four screws that fasten the NI 2565 relay module board to the switch carrier module and front panel.
3. Lift up the card as shown in Figure B-1.
4. Remove the relay by applying force in the direction shown in Figure B-2.
5. Before inserting the new relay, match the direction of the relay and the socket.
6. Insert the relay, making sure the relay is properly seated and the socket hooks the top of the relay.
7. Reassemble the module.

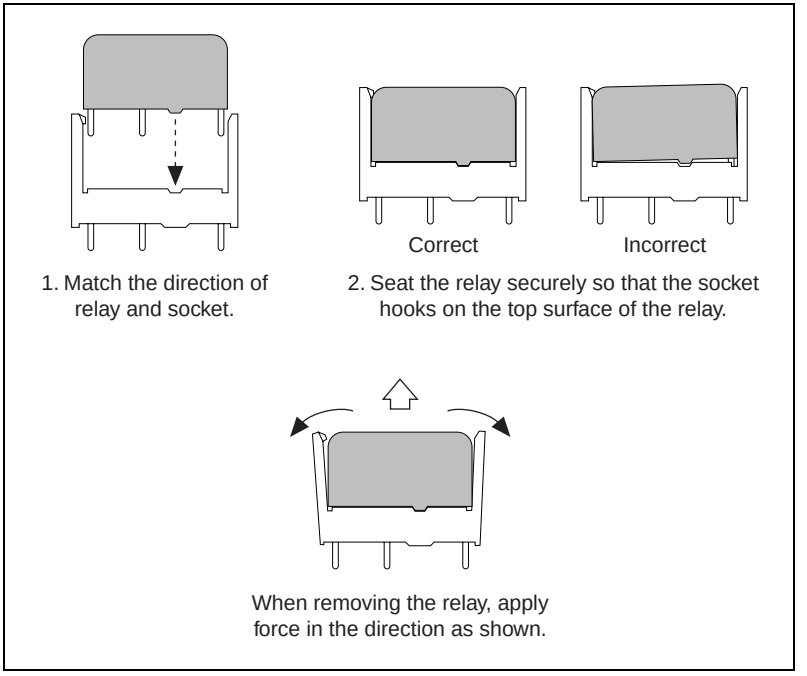

Correct
Incorrect
1. Match the direction of relay and socket.
2. Seat the relay securely so that the socket hooks on the top surface of the relay.
When removing the relay, apply force in the direction as shown.

Figure B-2. Replacing a Relay

C

Architecture Drawing

This appendix contains an architecture drawing for the NI 2565 switch card.

Relay names are based on the signal names. For example, the relay that connects CH9 to COM9 is named CH9.

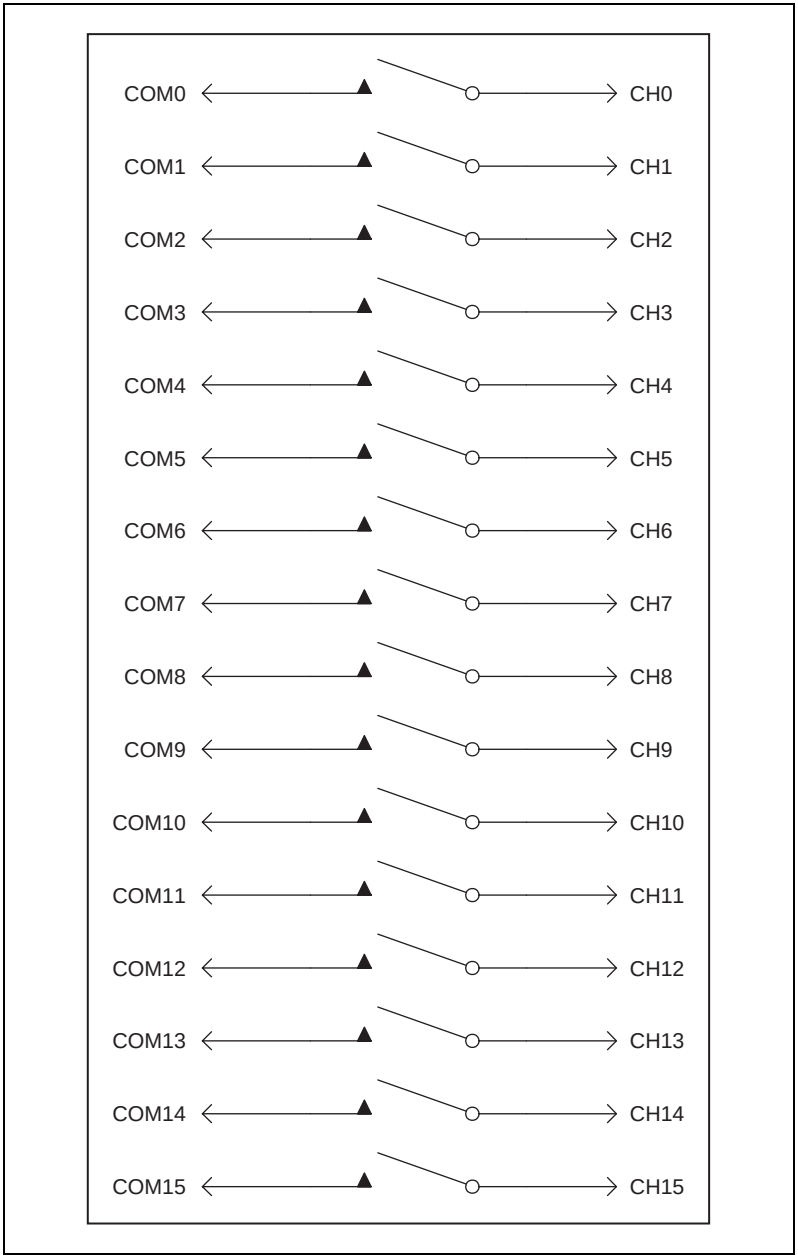


Figure C-1. NI 2565 Switch Architecture

D

Common Questions

This appendix addresses common questions you may have while using your NI 2565 switch card.

What should I do if the software detects the board but the switches do not switch?

- Verify that the switches do not switch. Close your application program and then launch the soft front panel as described in the *Set up and Test* document you received with your kit. The soft front panel shows the state of each relay on the board. Try closing and opening the switches.
- Also be sure to check the return codes of the NI-SWITCH operation to ensure that there are no errors (negative value) or warnings (positive value). You can also use the NI-Spy utility to check for error codes.
- Finally, verify that your code is correct. For reference, see the examples described in the *NI-SWITCH Software User Manual*. The NI-SWITCH driver also ships with several examples in source code. Compare your algorithm to those in the examples.

What should I do if scanning does not work?

- First, ensure that you have configured the switch card and the instrument to match trigger lines. The output trigger of the instrument should connect to the trigger input of the switch card. In addition, the scanner advanced trigger of the switch card should be connected to the input trigger of the instrument.
- If the switch card is used to initiate the scan, make sure the DMM is waiting for a trigger before enabling scanning on the switch card. This is the recommended method for hardware scanning.
- If the DMM is used to initiate the scan, enable scanning on the switch card before configuring the DMM to start taking measurements.
- Also be sure to check the return codes of the NI-SWITCH operation to ensure that there are no errors (negative value) or warnings (positive value). You can also use the NI-Spy utility to check for error codes.

- Finally, verify that your code is correct. For reference, see the examples described in the *NI-SWITCH Software User Manual*. The NI-SWITCH driver also ships with several examples in source code. Compare your algorithm to the ones in the examples.

Do I need to program the switch card myself?

The NI 2565 comes with the NI-SWITCH driver software, which exports the full functionality of the card. NI-SWITCH handles the complex issues of direct memory access, interrupts, and operating system interfacing.

E

Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve your technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a fax-on-demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by applications engineers.

Electronic Services

Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call 512 795 6990. You can access these services at:

United States: 512 794 5422
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 01 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as `anonymous` and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at 512 418 1111.

E-Mail Support (Currently USA Only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

`support@natinst.com`

Telephone and Fax Support

National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

Country	Telephone	Fax
Australia	03 9879 5166	03 9879 6277
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Brazil	011 288 3336	011 288 8528
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Québec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	09 725 725 11	09 725 725 55
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 6120092	03 6120095
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	5 520 2635	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
United Kingdom	01635 523545	01635 523154
United States	512 795 8248	512 794 5678

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___) _____Phone (___) _____

Computer brand_____ Model _____Processor_____

Operating system (include version number) _____

Clock speed _____MHz RAM _____MB Display adapter _____

Mouse ___yes ___no Other adapters installed_____

Hard disk capacity _____MB Brand_____

Instruments used _____

_____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is: _____

_____

_____

_____

_____

List any error messages: _____

_____

_____

The following steps reproduce the problem: _____

_____

_____

_____

_____

NI 2565 Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

Hardware revision _____

Switching mode_____

List National Instruments Software Installed and Version

NI-SWITCH version _____

LabVIEW version _____

LabWindows/CVI version_____

Other National Instruments software version _____

_____

Programming choice _____

Other Products

PXI chassis make and model_____

Microprocessor _____

Clock frequency or speed _____

Type of video board installed _____

Operating system version _____

Operating system mode_____

Programming language _____

Programming language version_____

Switch accessories_____

_____

Instruments connected to switch _____

_____

List All Boards in PXI Mainframe

PXI Slot	Manufacturer, Description, and Function
1	
2	
3	
4	
5	
6	
7	
8	

Documentation Comment Form

National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title: *NI 2565 User Manual*

Edition Date: December 1998

Part Number: 322121A-01

Please comment on the completeness, clarity, and organization of the manual.

_____

_____

_____

_____

_____

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If you find errors in the manual, please record the page numbers and describe the errors.

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_____

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Thank you for your help.

Name _____

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Mail to: Technical Publications
National Instruments Corporation
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Austin, Texas 78730-5039

Fax to: Technical Publications
National Instruments Corporation
512 794 5678

Glossary

Prefix	Meanings	Value
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}

Numbers and Symbols

°	degrees
Ω	ohms
%	percent
±	plus or minus
1form A	single-pole, single-throw relay

A

A	amperes
AC	alternating current
ANSI	American National Standards Institute

B

breakpoint	a specified point in program code where the program pauses to perform some action; a breakpoint interrupt can be added to a scan list for debugging or other special needs.

bus	the group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are the ISA and PCI bus.

C

C	Celsius
Category I, Category II, CAT I, CAT II	These categories refer to different levels in impulse voltage. Category I is at the signal level, and refers to special equipment or parts of equipment, telecommunication, electronic, and so on, with smaller transient overvoltages than Category II. Category II is local level, and refers to such items as appliances and portable equipment. The impulse withstand voltages for each category are as follows: **Voltage Phase-to_Earth Category I Category II** 150 V 800 V 1,500 V 300 V 1,500 V 2,500 V
channel	pin or wire lead on the multiplexer to which you apply or from which you read the analog or digital signal. Signals can be single-ended or differential.
contact bounce	the intermittent switching that occurs when the movable metal parts of a relay make or break contact

D

DC	direct current
debounced	indicates when the contact bounce has ended. *See* contact bounce.
device	a plug-in board, card, or pad that can contain multiple channels and conversion devices. Some examples of devices are computers, multimeters, multiplexers, oscillators, operator interfaces, and counters.
digital multimeter	a multifunction meter used to make measurements such as voltage, current, resistance frequency, temperature, and so on
DIN	Deutsche Industrie Norme
diode	an electronic component that acts primarily as a one-way valve

DMA	direct memory access—a method by which data can be transferred to/from computer memory from/to a device or memory on the bus while the processor does something else. DMA is the fastest method of transferring data to/from computer memory.
DMM	*See* digital multimeter.
drivers/driver software	software that controls a specific hardware device such as a switch card

E

external trigger	a voltage pulse from an external source that triggers an event such as A/D conversion

F

flyback voltage	the voltage spike generated the instant current stops flowing through an inductor

H

handshaking	the use of two trigger lines between two instruments, such as a switch and a DMM, to synchronize their actions
Hz	hertz—the number of scans read or updates written per second

I

in.	inches
Interchangeable Virtual Instrument	an advanced architecture for instrument drivers that includes features such as simulation and state caching
I/O	input/output—the transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces
ISA	Industry Standard Architecture
IVI	*See* Interchangeable Virtual Instrument.

M

MB	megabytes of memory

N

NI-SWITCH	an IVI-based instrument driver that supports the National Instruments line of switch cards

P

PXI	PCI with extensions for instrumentation

R

random scanning	scanning the channels in a mux in any order
relay	a switch that connects or disconnects the signal to a common through the physical movement of a metal arm
RMA	Return Material Authorization
rms	root mean square—the square root of the average value of the square of the instantaneous signal amplitude; a measure of signal amplitude
RTD	resistance temperature detector—a metallic probe that measures temperature based upon its coefficient of resistivity

S

s	seconds
scan	the data acquisition of signals connected to multiple channels of a multiplexer. Typically, the measurement device uses a trigger to advance the multiplexer to the next channel in the scan.
scan list	a list of channels supplied to NI-SWITCH that indicates the order in which channels will be scanned

scanner advanced trigger	the trigger generated by the switch card when scanning. The trigger occurs after the switch card has closed a switch and the switch has settled.
sensor	a device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal
settling time	the amount of time required for a voltage to reach its final value within specified limits
soft front panel	a graphical program included with NI-SWITCH that you can use to interactively control the switch

T

thermistor	a semiconductor sensor that exhibits a repeatable change in electrical resistance as a function of temperature. Most thermistors exhibit a negative temperature coefficient.
thermocouple	a temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
trigger	any event that causes or starts some form of data capture
TTL	Transistor-Transistor Logic

V

V	volts
varistor	an electrical resistor whose resistance depends on the applied voltage
VDC	volts, direct current
VI	virtual instrument—(1) a combination of hardware and/or software elements, typically used with a PC, that has the functionality of a classic stand-alone instrument (2) a LabVIEW software module (VI), which consists of a front panel user interface and a block diagram program

W

W	watts
wire	data path between nodes

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